Capri, M. Häckel was also occupied with these animals on the shores of Dalmatia, and had likewise ascertained the existence of zoosperms and ova in the calcareous and siliceous sponges*. The results of his researches had even been published a little before the memoir of M. Eimer. The latter, however, thinks Häckel, like Huxley and Lieberkühn, had not under examination any completely developed zoosperms, but only slightly advanced forms of those elements. As, however, Häckel has observed a direct fecundation, M. Eimer hazards the supposition that there may be some sponges in which the zoosperms are arrested at one of the inferior stages of their development.—*Archiv für mikroskopische Anatomie*, vol. viii. Heft 2; *Bibl. Univ.* August 15, 1872, *Bull. Scient.* p. 350.

Investigations upon the Development of the Gregarinæ.
By E. van Beneden.

The investigations of M. E. van Beneden upon the *Gregarina gigantea* of the lobster confirm the observations of Lieberkühn upon the transformation of certain amœboid forms into *Gregarinæ*; only the phases are here somewhat different from those observed in the *Gregarinæ* of the earthworm. The author found, in the small intestine of the lobster, some small, finely granular, protoplasmic masses, destitute both of membrane and nucleus. These masses, which are continually changing their form, greatly resemble *Protamœba primitiva* or *P. agilis* of Häckel, from which they differ only by presenting fine molecular granulations even to the periphery, and by never emitting true pseudopodia. According to Häckel's nomenclature, these would be true gymnocytodes.

Side by side with these we find small protoplasmic globules, which differ from them only by having lost the faculty of moving and changing their form. They have no enveloping membrane any more than the former; but their spheroidal form is preserved by a peripheral layer of denser and less fluid protoplasm.

With these globular and motionless forms we find others perfectly similar to them, except that they have one or two prolongations which cannot be assimilated to pseudopodia, but rather to the movable stalk of the *Noctilucæ*. M. van Beneden names these *generative cytodes*, because it is these which directly give birth to the *Gregarinæ*. When there are two prolongations, these are inserted at but a little distance apart. One of these prolongations, which is shorter and more slender and with paler outlines than the other, and only contains very fine granules, is almost destitute of mobility. When brought against a hard body, it is seen to bend; and the bend thus produced persists for a very long time. The other prolongation is considerably longer and stouter, with stronger outlines and a more refractive protoplasm. Besides a very fine punctation, it contains opaque granules, which are very numerous at its slightly widened extremity. This process is endowed with an extreme mobility, which is manifested in two modes. It may swing about like the stalk of the *Noctilucæ*, or present an inflection

* Jenaische Zeitschrift, vol. vi. Heft 4.

which is propagated from the extremity towards the base, and which is followed by a sudden straightening of the whole arm. At the same time that this movement of straightening is made, a current carries the granular protoplasm from the centre of the cytode into the interior of the arm. This action repeated produces an elongation of the arm, which is accompanied by a narrowing of its basal portion and an accumulation of opaque granulations in its terminal part.

When the mobile arm has attained a certain length, it separates from the body of the cytode, and moves like a Nematode worm. We shall soon see what further transformations it undergoes.

After this arm has separated and acquired an independent existence, the other process follows the course of its development, and arrives at the same state as the former one; only for this purpose it requires the whole remainder of the body of the cytode.

If M. van Beneden has correctly coordinated the different phases which he has been able to observe in the intestine of the lobster, we must conclude that a single cytode gives origin successively to two prolongations, each destined to become developed into a *Gregarina*: one separates from the body of the cytode, the other absorbs the rest of that body.

These protoplasmic filaments, endowed with very active movements, the author designates by the name of *pseudofilariæ*; he supposes that it is their resemblance to young Nematode worms which has led certain authors to assume that the *Gregarinæ* are a phase in the evolution of the Nematoda.

These pseudofilariæ are thinned at one of their extremities, and slightly inflated at the opposite (cephalic) extremity, which is always strongly charged with refractive granules. After a certain period of activity their movements slacken; the length of the body gradually diminishes at the same time that its width increases, especially in the anterior part. Then all movement ceases, and the pseudofilaria remains motionless. Towards the middle of the body, there appears a dark circular spot, formed by a material more refractive than the protoplasm, and the limits of which become more and more distinct; this is the *nucleolus*. Around the nucleolus there appears a transparent zone without granulations, the limits of which are at first not very distinct, and which becomes the *nucleus* of the cell. The pseudofilaria shortens and becomes more or less oval; and an anterior projection or swelling, in which the refractive granules have a tendency to accumulate, begins to be distinguishable.

We have then before us a *Gregarina* which has no longer any important changes to undergo. It becomes elongated and acquires more and more the form of a tube slightly dilated in its anterior part. The posterior part becoming more elongated than the anterior, the nucleus finally settles at the extremity of the anterior third of the body. The refractive granules accumulated in the anterior terminal inflection form a mass separated from the granular protoplasm of the rest of the body by a sort of transverse septum, formed

by a layer of transparent protoplasm. The external part of the protoplasm of the body, which at first formed a simple homogeneous and transparent layer without granules, becomes more and more distinctly bounded, and soon presents the form of a membrane with a double contour. The nucleus becomes regularly oval and also surrounds itself with a membrane.

By these changes and its increase in size the pseudofilaria finally acquires the definitive form of *Gregarina gigantea*, and a length of as much as 16 millims.

M. van Beneden follows this description of the development of the *Gregarina* with some very interesting general considerations upon the Monera and the Monerian phase of the *Gregarinæ*. According to him, if we admit that the substance of the Monera and cytodes is identical with the sarcode of the Rhizopoda and the protoplasm of cells, as regards *physical and vital properties*, we must regard it as different from those bodies from a chemical point of view, since it also contains the elements of the nuclear organs, which are differentiated from it in the cell. He consequently proposes the name of *plasson* for the *constitutive substance of the body of the Monera and cytodes*. Although recognizing with him that both in the ontogenic and in the phylogenic series we always, at the beginning, find this *plasson* before meeting with cell-formations, it seems to us that the necessity for this neologism has not yet made itself felt. Our knowledge with regard to the nuclear formations compared with protoplasm is too unsatisfactory to render it very urgent for us to distinguish these substances by names destined to indicate their chemical differences. Moreover, if we were to commence this course, we could not stop at the nomenclature proposed by M. van Beneden; it would be necessary to have:—a first name for the living substance which does not present either nucleolus, nucleus, or enveloping membrane; a second for that which has already abandoned the elements necessary for the formation of the nucleolus; a third for that from which have been separated the elements of a nucleolus and a nucleus, bodies which M. van Beneden regards as chemically distinct (p. 146); and a fourth for that which, besides these nuclear organs, has furnished the elements of an enveloping membrane. This list is still incomplete; we should have to add to it, among others, the protoplasm of the lepocytodes. It must be remarked, moreover, that the substance to which M. van Beneden wishes to give the name of *plasson*, on account of its chemical composition, is already a complex substance, even from a histological point of view, since the author recognizes in the interior of the transparent mass granules of two kinds, one kind being regarded by him as nutritive, combustible elements; he even explains, by the presence or absence of these granules, the different manner in which the movable and immovable arms of the *Gregarinæ* in the amœboid state behave.

The ontogenic development of the *Gregarinæ*, as M. van Beneden indicates, represents in an abridged form the phylogenic development of the cell. We have here an example of endogenous generation by the formation of the nucleus in the body of the pseudo-

filaria; but in the nuclear formation it is the nucleolus that first appears—a fact which it is important to notice, and which is the more striking because M. van Beneden has observed in the adult *G. gigantea* a successive disappearance and reappearance of the nucleoli.

To sum up, the *Gregarina* of the lobster would pass, in the course of its embryonic development, through the following phases:—the Monerian phase, the phase of the generative cytode, that of the pseudofilaria, that of the protoplast, that of the encysted *Gregarina*, and that of psorospermia.

There would therefore be in its evolution two phases during which reproduction would take place by division:—1, that which gives origin to the psorospermiæ after encystation; 2, that in which the generative cytode produces pseudofilariæ.—*Journal de Zoologie*, tome i. (1872) pp. 134–165; *Bibl. Univ., Arch. des Sci.* July 15, 1872, p. 256.

Diatoms in Hot Springs.

Dr. Blake has collected diatoms at a hot spring in Pueblo valley, Humboldt Co., Nevada, the temperature of which was 163° F. More than fifty different species were recognized by him; and they were found to be mostly identical with the species found in beds of infusorial earth in Utah and described by Ehrenberg, showing that the latter must have been accumulated in a hot lake, of about the same temperature. No other living species were found in the hot waters, excepting red algæ. The deposit was a large one, and in it there were concretions of silica. On making a thin section of one of these concretions, a pair of legs of a coleopterous insect were visible in the quartz; the greater part of the concretion was made up of petrified algæ.

In one of the hot springs at the California geysers, having a temperature of 198° F., he found two kinds of Conferva—one capillary, resembling *Hydrocrocis Bischoffii*, but larger; the other a filament, with globular enlargements at intervals. In another spring, the temperature 174° F., many Oscillariæ were found, which by the interlacement of their delicate fibres formed a semigelatinous mass, and also two diatoms. In the water of the creek of Geyser Cañon, 112° F., the algæ formed layers sometimes 3 inches thick, covering the bottom of the pools, and the same diatoms were found as in the 174° spring. The waters are acidulated by the presence of free sulphuric acid; and Dr. Blake suggests that this may account for the rarity of diatoms.—*Proc. Cal. Acad. Sci.* iv. pp. 183, 189, 193, 197.

On the Habits of Galeodes pallipes. By Prof. Cope.

Prof. Cope exhibited a specimen of a *Galeodes*, probably *G. pallipes* of Say, taken in the town of Denver, Colorado, by Dr. Gehrung. According to that gentleman, it was common in that place in houses, and was an enemy and destroyer of the *Cimex lectularius* (bed-bug). In captivity, it showed a preference for them as food, and crushed them in its short falces, preliminary to sucking their juices.—*Proc. Acad. Nat. Sci. Phil.* part iii. p. 295 (1872).